

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-007066

(43)Date of publication of application : 14.01.1993

(51)Int.Cl.

H05K 3/20

H05K 3/00

(21)Application number : 03-157164

(71)Applicant : TOSHIBA CORP

(22)Date of filing : 27.06.1991

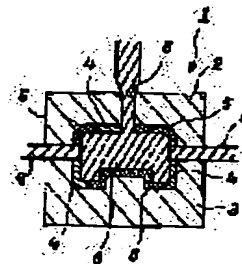
(72)Inventor : MOTOMURA TOMOHISA

(54) MANUFACTURE OF PRINTED WIRING BOARD

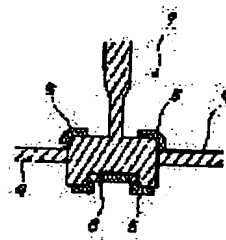
(57)Abstract:

PURPOSE: To provide a printed wiring board manufactured by injection-molding, wherein it is realizable to make a wiring pattern into a fine pattern, and the wiring pattern can be formed in a short time, and further, the bonding strength of the wiring pattern is improved.

CONSTITUTION: A wiring pattern 5 is formed by bonding metallic conductors to the inner surface of a metallic mold for injection-molding with electric plating. Since the electric plating is used for forming the wiring pattern made of the metallic conductors, the wiring pattern 5 having a high bonding density and a high reliability of its bonding strength can be formed in a short time. A base board 6 is injection-molded by injecting a thermoplastic resin into the metallic mold 1 for injection-molding. Then, the wiring pattern 5 is heated using a metallic mold 10 for heating, and the base board 6 is fused by making its temperature rise to the temperature about 20-70° C higher than the fusing point of the thermoplastic resin. Thereby, the base board 6 is bonded to the wiring pattern 5 by fusing, and the bonding strength of the wiring pattern 5 is improved.



(a)



(b)

LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

***NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.**** shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1] A manufacture method of a printed wired board characterized by providing the following of injection molding thermoplastics in a injection molding die said injection molding — public funds — what a plating resist pattern is stuck on an inside, and a mold becomes from the good quality of the material of a metaled mold—release characteristic — it is — said injection molding — public funds — a production process in which make a metallic conductor put on a portion on which said plating resist pattern of an inside of a mold is not put by electroplating, and a desired metallic conductor circuit pattern is made to form A production process which imprints said metallic conductor circuit pattern put on an inside of said metal mold for injection molding to said substrate while pouring thermoplastics into said metal mold for injection molding and injection molding a substrate of a printed wired board A production process which releases said metallic conductor circuit pattern and said substrate from mold from said metal mold for injection molding A production process which heats said metallic conductor circuit pattern and heats the temperature more than melting temperature of said thermoplastics

[Claim 2] A manufacture method of a printed wired board given in the 1st term of a claim of imprinting said metallic conductor circuit pattern to said substrate, making said metallic conductor circuit pattern flowing through current the back, and heating temperature of said metallic conductor circuit pattern by pyrexia by the electric resistance more than melting temperature of said thermoplastics.

[Claim 3] A manufacture method of a printed wired board given in the 1st term of a claim of heating temperature of said metallic conductor circuit pattern with heat at the time of said soldering more than melting temperature of said thermoplastics in case said metallic conductor circuit pattern is imprinted to said substrate and external electronic parts are soldered to said printed wired board the back.

[Translation done.]

*** NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacture method of a printed wired board of injection molding thermoplastics.

[0002]

[Description of the Prior Art] In recent years, fabrication of the printed wired board is carried out to a three-dimensional configuration, the printed wired board which comes to injection mold thermoplastics is developed to the use of using itself as a case (case) of an electric machine or electronic equipment, and a part has already come to be put in practical use.

[0003] While being able to attain the further miniaturization of electronic equipment as compared with the case where the printed wired board which the former became independent of is used, by forming this printed wired board in a three-dimensional configuration, and using it as a case of electronic equipment, there is a merit that the cost cut of passive circuit elements can be aimed at.

[0004] After injection molding thermoplastics, using injection-molding metal mold as the manufacture method of the printed wired board by this injection molding, forming the substrate which is the main part of a printed wired board and making it release from mold from injection-molding metal mold, the metallic conductor circuit pattern is made to put on the portion on which a plating resist pattern is stuck on a substrate and the plating resist pattern is not stuck by the additive process by chemical plating, such as non-electrolytic copper plating. In order to strengthen more adhesion of the substrate made of synthetic resin, and a metal metallic conductor circuit pattern at this time, the technology of roughening the resin on the surface of a substrate by polishing etc. as pretreatment of chemical plating, or making a catalyst mixing in synthetic resin beforehand, and giving an anchor effect to the metallic conductor circuit pattern which should be made putting is used.

[0005] Since the printed wired board by injection molding uses such an additive process for formation of a circuit pattern, unlike a complicated production process like a printed wired board that repeat etching and plating and a circuit pattern is formed by the conventional subtractive process, it is what has the very simple production process which forms a circuit pattern. And it also has the merit that it is more clean and futility can make a manufacturing cost low few as compared with a subtractive process with the problem of the after treatment of an etching reagent, or the useless problem of outer layer ****.

[0006] however, now by the method of forming a circuit pattern according to this additive process Therefore fine patternizing is difficult for the local bias of the plating liquid concentration in a nonelectrolytic plating process etc. Moreover, there is a problem that the time amount which covering of the metal of a circuit pattern takes is as long as a degree abbreviation half a day from several hours, the time amount compaction beyond it is difficult, and manufacture effectiveness is low in order that covering density, reinforcement, etc. may make it inferior remarkably, if you are going to make it cover for a short time.

[0007] Thus, in circuit pattern formation of the printed wired board by injection molding, there was a problem of fine patternizing having been difficult and taking circuit pattern formation time amount for a long time, by the manufacture method using an additive process like before.

[0008]

[Problem(s) to be Solved by the Invention] This invention is to offer the manufacture method of the printed wired board by injection molding which it was made in view of such a problem, and the place made into the purpose could realize fine patternizing of a circuit pattern in the manufacture method of the printed wired board by injection molding, and enabled it to form a circuit pattern for a short time, and raised the covering reinforcement of a circuit pattern further.

[0009]

[Means for Solving the Problem] In a manufacture method of a printed wired board that a manufacture method of a printed wired board of this invention injection molds thermoplastics in a injection molding die Said metal mold for injection molding is what a plating resist pattern is stuck on an inside, and consists of the good quality of the material of a metaled mold-release characteristic. A production process in which make a metallic conductor put on a portion on which said plating resist pattern of an inside of said metal mold for injection molding is not put by electroplating, and a desired metallic conductor circuit pattern is made to form, While pouring thermoplastics into said metal mold for injection molding and injection molding a substrate of a printed wired board A production process which imprints said metallic conductor circuit pattern put on an inside of said metal mold for injection molding to said substrate, It is characterized by providing a production process which releases said metallic conductor circuit pattern and said substrate from mold from said metal mold for injection molding, and a production process which heats said metallic conductor circuit pattern and heats the temperature more than melting temperature of said thermoplastics.

[0010]

[Function] After making the inside of the metal mold for injection molding put a metallic conductor by electroplating and forming a metallic conductor circuit pattern, thermoplastics is poured into the metal mold for injection molding, and a substrate is injection molded. Since the above-mentioned metallic conductor circuit pattern has the good mold-release characteristic from a injection molding die at this time, the poured-in thermoplastics side, i.e., a substrate, imprints and the printed wired board on which the desired metallic conductor circuit pattern was stuck is formed. And since the condition of this as is not enough as the adhesion reinforcement to the substrate of a metallic conductor circuit pattern, a metallic conductor circuit pattern is heated, as it becomes the temperature more than the melting temperature of that thermoplastics, melting of the substrate which touches this is carried out to it, welding is carried out to a metallic conductor circuit pattern, and that adhesion reinforcement is strengthened.

[0011] Thus, since electroplating is used for formation of a metallic conductor circuit pattern, a metallic conductor circuit pattern with high covering density and reliability on the strength can form in a short time. Moreover, since the resin at the time of injection molding and not only the metaled imprint depended for biting but a substrate is fused and welding is carried out to a metallic conductor circuit pattern, the adhesion reinforcement is strengthened sharply.

[0012]

[Example] Hereafter, the example of this invention is explained to details based on a drawing.

[0013] Drawing 1 is the side cross section showing the injection molding die concerning the manufacture method of this invention, and the printed wired board formed by that cause.

[0014] In the manufacture method of the printed wired board concerning this invention, the injection molding die 1 as shown in drawing 1 is used.

[0015] This metal mold 1 for injection molding uses as a base material the cemented carbide which added CO (carbon monoxide) to WC (tungsten carbide). Carry out Zagury processing of this in NC machining, and the injection molding-die main parts 2 and 3 of a female mold are fabricated. This whole inside is made to put i-carbon film which is an insulating material according to a thin film formation process, laser removes i-carbon film of a circuit pattern portion to form, and it is made for the remaining portion to serve as the electroplating resist 4.

[0016] injection molding which used the cemented carbide of above-mentioned WC(tungsten carbide)+CO (carbon monoxide) as the base material — public funds — the main parts 2 and 3 of a mold have the good covering nature of i-carbon film, and, moreover, it has become the good thing of a mold-release characteristic to thermoplastics, such as metals, such as Cu (copper), and PPS (polyphenylene sulfide)

resin).

[0017] Cu (copper) is deposited with electrolytic copper plating into the portion which has not given the electroplating resist 4 of the inside of such metal mold 1 for injection molding, the desired circuit pattern 5 is formed, and the inside of these main parts 2 and 3 for injection molding of metal mold is made to once cover.

[0018] this injection molding -- public funds -- thermoplastics, such as the inlet 8 established in the upper part of a mold 1 to polyphenylene sulfide resin, -- injection molding -- public funds -- it pours into the interior of a mold 1, and the substrate 6 which is the main part of a printed wired board 7 is injection molded in a desired configuration.

[0019] The above-mentioned circuit pattern 5 which the inside of the main parts 2 and 3 for injection molding of metal mold was made to once put is imprinted by the heat and pressure at the time of that injection molding on the substrate 6 by which injection molding was carried out to this injection molding and coincidence. in this case, the circuit pattern 5 made from this Cu (copper) -- a substrate 6 -- biting -- injection molding -- public funds -- it releases from mold from the main parts 2 and 3 of a mold, and imprints on a substrate 6.

[0020] In this way, as a main part is injection molded, a circuit pattern 5 is imprinted and it is shown in drawing 1 (b) the back, this printed wired board is taken out from the injection molding die 1, and the weld flash produced at the time of resin impregnation is removed.

[0021] Further and in order [to the substrate 6 of a circuit pattern 5] to eat and to strengthen **** injection molding -- public funds -- heating with which plating resist is not stuck with the same configuration and same quality of the material as a mold 1 -- public funds -- a mold 10 The circuit pattern 5 of a printed wired board 7 is made to contact, it heats until it applies heat to this metal mold 10 whole for heating and becomes it from the exterior more than the melting temperature of thermoplastics, and melting of the thermoplastics of the substrate 6 which touches a circuit pattern 5 is carried out, and welding of a substrate 6 and the circuit pattern 5 is carried out firmly. This is shown in drawing 2.

[0022] a circuit pattern 5 is stuck on the external surface of the substrate 6 of a printed wired board 7 -- having -- **** -- the external surface of a substrate 6 -- the part protrusion of the thickness -- it is carrying out. for this reason, heating -- public funds -- if the pressure welding of the mold 10 is carried out to a printed wired board 7 -- heating -- public funds -- since a mold 10 contacts only the projected circuit pattern 5 -- heating -- public funds -- even if it applies heat to the mold 10 whole, heat is conducted only to a circuit pattern 5, melting only of the portion which touches the circuit pattern 5 of a substrate 6 is carried out, and welding of it is carried out.

[0023] at this time, the temperature of the thermoplastics of a portion with which the circuit pattern 5 is stuck becomes higher [about 70 degrees C] from 20 degrees C than that melting temperature -- as -- if it heats about 3 seconds, moreover, there will be no effect of a substrate 6 and five circuit pattern in other parts firmly -- most -- good -- it is checked in enforcement of this example in the condition condition that welding is carried out.

[0024] The adhesion reinforcement of the circuit pattern 5 and substrate 6 of a printed wired board 7 which were manufactured by such manufacture method was measured. Consequently, in the case of the circuit pattern formed of the conventional additive process, it is adhesion reinforcement. 0.2-0.3kg/mm² With the circuit pattern 5 of the printed wired board 7 which requires for this invention what was a degree, it is 2 1.0 to 1.5 kg/mm. The adhesion reinforcement is strengthened remarkably and it was checked that it is reliable and the practicality of reliability is fully high.

[0025] in addition, a strengthening of the adhesion reinforcement to the substrate 6 top of a circuit pattern 5 in this example sake -- heating -- public funds -- although melting of the portion which the circuit pattern 5 and the substrate 6 have joined is carried out to a mold 10 and it carries out welding to it by applying heat from the exterior, as the heating method, it does not limit to this. for example, the printed wired board 7 -- injection molding -- public funds -- the condition of it having been formed in the mold 1 and having been held -- injection molding -- public funds -- a mold 1 may be heated and heat may be applied to the printed wired board 7 whole. However, since portions other than circuit pattern 5 are also

heated to a melting temperature degree in this case, it is necessary to change an above-mentioned heating temperature and the heating time in an example, and to set up the heating conditions which suited this method.

[0026] In addition, pass a high current for the printed wired board 7 by which the circuit pattern 5 was imprinted from the injection molding die 1 to the ejection circuit pattern 5, and this is made to generate heat with the electric resistance. The method of carrying out melting of the portion which the substrate 6 and the circuit pattern 5 have joined, and carrying out welding. In case an external element, passive circuit elements, etc. are soldered to a printed wired board 7, a circuit pattern 5 and a substrate 6 may be heated with the heat at the time of heating for flow soldering, vapor reflow soldering, etc., and the method of carrying out welding of a circuit pattern 5 and the substrate 6 etc. may be used.

[0027] Moreover, although it is required that the thermoplastics which should be used in this invention should be equipped with the goodness of electric insulation suitable as a printed wired board, thermal resistance, moisture resistance, and a moldability etc., as what suits this, polycarbonate resin, polysulfone resin, polyether sulphone resin, polyacetal resin, polyether ketone resin, polyetherimide resin, polyphenylene oxide resin, etc. are mentioned other than the polyphenylene sulfide resin used in the above-mentioned example.

[0028] In this example, as an example of the printed wired board to manufacture, as shown in drawing 1 , the plastics chip carrier is chosen in fact. Since it conforms to the meaning of the printed wired board which a plastics chip carrier has a crevice in the center, and this is carrying out the three-dimensional gestalt, and requires it for the manufacture method of this invention, it is because chip carriers are a size handy as a prototype of the example of the gestalt up this invention, and a configuration. However, this invention is the suitable technology for manufacture of the three-dimensional printed wired board which is not limited only to the plastics chip carrier of a gestalt like this example, but is formed in the configuration of manufacture of a printed wired board at large [by injection molding], especially a case, etc.

[0029]

[Effect of the Invention] As explained to details above, according to the manufacture method of the printed wired board of this invention, in circuit pattern formation of the printed wired board by injection molding, can realize fine patternizing of a circuit pattern, and it enables it to form a circuit pattern for a short time, and the printed wired board by injection molding which raised the covering reinforcement of a circuit pattern further can be offered.

[Translation done.]

*** NOTICES ***

Japan Patent Office is not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. **** shows the word which can not be translated.
3. In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The side cross section showing the injection molding die concerning the manufacture method of this invention, and the printed wired board formed by that cause.

[Drawing 2] heating concerning the manufacture method of this invention — public funds — the side cross section in which a mold and it show the printed wired board by which the pressure welding was carried out.

[Description of Notations]

- 1 — Metal mold for injection molding
- 2 3 — Main part for injection molding of metal mold
- 4 — Electroplating resist
- 5 — Circuit pattern
- 6 — Substrate
- 7 — Printed wired board
- 8 — Inlet
- 9 — Bearing bar
- 10 — Metal mold for heating

[Translation done.]

(19)日本国特許庁 (J P)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開平5-7066

(43)公開日 平成5年(1993)1月14日

(51)Int.Cl.⁵

H 0 5 K 3/20
3/00

識別記号

庁内整理番号

F I

技術表示箇所

B 6736-4E

A 6921-4E

審査請求 未請求 請求項の数3(全 5 頁)

(21)出願番号 特願平3-157164

(22)出願日 平成3年(1991)6月27日

(71)出願人 000003078

株式会社東芝

神奈川県川崎市幸区堀川町72番地

(72)発明者 本村 知久

神奈川県横浜市磯子区新磯子町33 株式会

社東芝横浜事業所磯子工場内

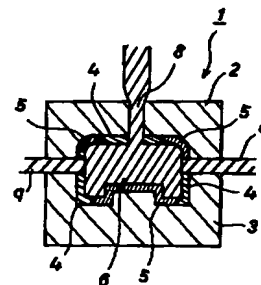
(74)代理人 弁理士 須山 佐一 (外1名)

(54)【発明の名称】 プリント配線板の製造方法

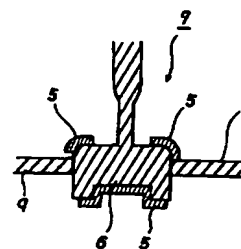
(57)【要約】

【目的】 配線パターンのファインパターン化が実現でき、かつ配線パターンを短時間で形成できるようにし、さらに配線パターンの被着強度を向上させた、射出成形によるプリント配線板を提供する。

【構成】 射出成形用金型1の内面に電気めっきにより金属導体を被着させて配線パターン5を形成する。金属導体の配線パターン5の形成に電気めっきを用いているので被着密度や強度信頼性の高い配線パターン5が短時間で形成できる。射出成形用金型1に熱可塑性樹脂を注入して基板6を射出成形する。そして加熱用金型10を用いて配線パターン5を加熱して、基板6をその熱可塑性樹脂の熔融温度よりも20℃から70℃程度高くなるようにして熔融させ、配線パターン5に融着させてその密着強度を強める。



(a)



(b)

(2)

【特許請求の範囲】

【請求項1】 熱可塑性樹脂を射出成形用金型にて射出成形するプリント配線板の製造方法において、前記射出成形用金型は内面にめっきレジストパターンが貼設され、かつ金属の離型性の良い材質よりなるものであって、前記射出成形用金型の内面の前記めっきレジストパターンが被着されていない部分に電気めっきにより金属導体を被着させて所望の金属導体配線パターンを形成させる工程と、前記射出成形用金型に熱可塑性樹脂を注入してプリント配線板の基板を射出成形するとともに、前記射出成形用金型の内面に被着されていた前記金属導体配線パターンを前記基板に転写する工程と、前記金属導体配線パターンおよび前記基板を、前記射出成形用金型から離型する工程と、前記金属導体配線パターンを加熱して、その温度を前記熱可塑性樹脂の熔融温度以上に加熱する工程と、を具備するプリント配線板の製造方法。

【請求項2】 前記金属導体配線パターンを前記基板に転写した後、前記金属導体配線パターンに電流を導通させ、その電気抵抗による発熱で前記金属導体配線パターンの温度を前記熱可塑性樹脂の熔融温度以上に加熱する請求項第1項記載のプリント配線板の製造方法。

【請求項3】 前記金属導体配線パターンを前記基板に転写した後、外部の電子部品を前記プリント配線板にはんだ付けする際に、前記はんだ付け時の熱により前記金属導体配線パターンの温度を前記熱可塑性樹脂の熔融温度以上に加熱する請求項第1項記載のプリント配線板の製造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は熱可塑性樹脂を射出成形するプリント配線板の製造方法に関する。

【0002】

【従来の技術】 近年、プリント配線板を立体的な形状に成形加工し、それ自体を電気機械あるいは電子機器の筐体（ケース）として使用する、といった用途に対して、熱可塑性樹脂を射出成形してなるプリント配線板が開発され、既に一部実用化されるに至っている。

【0003】 このプリント配線板を立体的な形状に形成して電子機器の筐体として用いることで、従来の独立したプリント配線板を用いる場合と比較して電子機器の更なる小型化が図れるとともに、回路部品のコストダウンを図ることができるというメリットがある。

【0004】 この射出成形によるプリント配線板の製造方法としては、射出成形用金型を用いて熱可塑性樹脂を射出成形してプリント配線板の本体である基板を形成し射出成形用金型から離型させたのち、基板上にめっきレジストパターンを貼設し、無電解銅めっきなど化学めっきによるアディティブプロセスによってめっきレジストパターンが貼設されていない部分に金属導体配線パターンを被着させている。このとき、合成樹脂製の基板と金属製

2

の金属導体配線パターンとの密着性をより強固にするために、化学めっきの前処理として基板表面の樹脂を研磨などで粗化し、あるいはあらかじめ合成樹脂に触媒を混入させるなどして、被着させるべき金属導体配線パターンにアンカー効果を与える技術が用いられている。

【0005】 射出成形によるプリント配線板は、配線パターンの形成にこのようなアディティブプロセスを用いているので、従来のサブトラクティブ法によってエッチングおよびめっきを繰り返して配線パターンが形成されるプリント配線板のような煩雑な工程とは異なり、配線パターンを形成する工程が極めて簡易なものとなっている。しかもエッチング液の後処理の問題や外層銅薄の無駄の問題があるサブトラクティブ法と比較して、よりクリーンで無駄が少なく製造コストを低くできるというメリットをも有している。

【0006】 しかしながら、現在のところ、このアディティブプロセスにより配線パターンを形成する方法では、無電解めっきプロセスにおけるめっき液濃度の局所的な偏り等によってファインパターン化が困難であり、また配線パターンの金属の被着に要する時間が数時間から約半日程度と長く、もし短時間に被着させようとすると被着密度や強度等が著しく劣悪化するために、それ以上の時間短縮が困難で製造効率が低い、という問題がある。

【0007】 このように、射出成形によるプリント配線板の配線パターン形成において、従来のようなアディティブプロセスを用いた製造方法では、ファインパターン化が困難であり、また配線パターン形成時間が長くなる、という問題があった。

【0008】

【発明が解決しようとする課題】 本発明は、このような問題に鑑みてなされたもので、その目的とするところは、射出成形によるプリント配線板の製造方法において、配線パターンのファインパターン化が実現でき、かつ配線パターンを短時間で形成できるようにし、さらに配線パターンの被着強度を向上させた、射出成形によるプリント配線板の製造方法を提供することにある。

【0009】

【課題を解決するための手段】 本発明のプリント配線板の製造方法は、熱可塑性樹脂を射出成形用金型にて射出成形するプリント配線板の製造方法において、前記射出成形用金型は内面にめっきレジストパターンが貼設され、かつ金属の離型性の良い材質よりなるものであって、前記射出成形用金型の内面の前記めっきレジストパターンが被着されていない部分に電気めっきにより金属導体を被着させて所望の金属導体配線パターンを形成させる工程と、前記射出成形用金型に熱可塑性樹脂を注入してプリント配線板の基板を射出成形するとともに、前記射出成形用金型の内面に被着されていた前記金属導体配線パターンを前記基板に転写する工程と、前記金属導

(3)

3

体配線パターンおよび前記基板を前記射出成形用金型から離型する工程と、前記金属導体配線パターンを加熱して、その温度を前記熱可塑性樹脂の熔融温度以上に加熱する工程と、を具備することを特徴としている。

【0010】

【作用】射出成形用金型の内面に電気めっきにより金属導体を被着させて金属導体配線パターンを形成したのち、その射出成形用金型に熱可塑性樹脂を注入して基板を射出成形する。このとき、前述の金属導体配線パターンは、射出成形用金型からの離型性が良いので、注入された熱可塑性樹脂側即ち基板に転写されて、所望の金属導体配線パターンが貼設されたプリント配線板が形成される。そしてこのままの状態では金属導体配線パターンの基板への密着強度が十分ではないので、金属導体配線パターンを加熱して、これに接する基板をその熱可塑性樹脂の熔融温度以上の温度になるようにして熔融させ、金属導体配線パターンに融着させてその密着強度を強める。

【0011】このように、金属導体配線パターンの形成に電気めっきを用いているので被着密度や強度信頼性の高い金属導体配線パターンが短時間で形成できる。また、射出成形時の樹脂と金属の食い付きによる転写だけでなく、基板を熔融して金属導体配線パターンに融着させているので、その密着強度は大幅に強化される。

【0012】

【実施例】以下、図面に基いて本発明の実施例を詳細に説明する。

【0013】図1は本発明の製造方法に係る射出成形用金型およびそれにより形成されるプリント配線板を示す側面断面図である。

【0014】本発明に係るプリント配線板の製造方法においては、図1に示すような射出成形用金型1を用いる。

【0015】この射出成形用金型1は、WC（炭化タングステン）にCO（一酸化炭素）を加えた超硬合金を母材とし、これをNC加工にてザグリ加工して離型の射出成形用金型本体2、3を成形し、この内面全体に薄膜形成プロセスにより絶縁体であるi-カーボン膜を被着させ、形成したい配線パターン部分のi-カーボン膜をレーザーにて除去して残りの部分が電気めっきレジスト4となるようにしたものである。

【0016】前述のWC（炭化タングステン）+CO

（一酸化炭素）の超硬合金を母材とした射出成形用金型本体2、3は、i-カーボン膜の被着性が良く、しかもCu（銅）などの金属およびPPS（ポリフェニレンサルファイド樹脂）などの熱可塑性樹脂に対して離型性の良いものとなっている。

【0017】このような射出成形用金型1の内面の、電気めっきレジスト4を施していない部分に電気銅めっきによりCu（銅）を析出させて、所望の配線パターン5

4

を形成し、一旦この射出成形用金型本体2、3の内面に被着させておく。

【0018】この射出成形用金型1の上部に設けられた注入口8からポリフェニレンサルファイド樹脂などの熱可塑性樹脂を射出成形用金型1の内部に注入して、プリント配線板7の本体である基板6を所望の形状に射出成形する。

【0019】一旦射出成形用金型本体2、3の内面に被着させておいた前述の配線パターン5は、この射出成形と同時に、射出成形された基板6上にその射出成形時の熱と圧力によって転写される。この場合、このCu（銅）製の配線パターン5は基板6との食い付きによって、射出成形用金型本体2、3から離型して基板6上に転写される。

【0020】こうして本体を射出成形し配線パターン5を転写してのち、図1（b）に示すようにこのプリント配線板を射出成形用金型1から取り出して、樹脂注入時に生じたバリを取り去る。

【0021】そして、さらに配線パターン5の基板6への食い付きを強固にするために、射出成形用金型1と同様の形状および材質で、めっきレジストが貼着されていない加熱用金型10を、プリント配線板7の配線パターン5に当接させ、この加熱用金型10全体に外部から熱を加えて熱可塑性樹脂の熔融温度以上になるまで加熱し、配線パターン5に接する基板6の熱可塑性樹脂を熔融させて基板6と配線パターン5とを強固に融着させる。これを図2に示す。

【0022】配線パターン5はプリント配線板7の基板6の外面に貼着されており、基板6の外面よりもその厚みの分突出している。このため加熱用金型10をプリント配線板7に圧接させると、加熱用金型10は突出している配線パターン5にのみ当接するので、加熱用金型10全体に熱を加えても、熱は配線パターン5のみに伝導され、基板6の配線パターン5に接する部分のみが熔融され、融着される。

【0023】このとき、配線パターン5が貼設されている部分の熱可塑性樹脂の温度がその熔融温度よりも20℃から70℃程度高くなるように3秒程度加熱すれば、基板6と配線パターン5とが強固に、しかもその他の部位に影響のない最も好条件な状態で融着されることが、本実施例の施行にあたって確認されている。

【0024】このような製造方法によって製造されたプリント配線板7の、配線パターン5と基板6との密着強度を計測した。その結果、従来のアディティブプロセスにより形成された配線パターンの場合では、密着強度は0.2~0.3kg/mm²程度であったものが、本発明にかかるプリント配線板7の配線パターン5では、1.0~1.5kg/mm²と、その密着強度は著しく強化されており、十分に信頼性が高く実用性の高いものであることが確認された。

(4)

【0025】なお、本実施例では配線パターン5の基板6上への密着強度の強化のために、加熱用金型10に外部から熱を加えることで、配線パターン5と基板6とが接合している部分を溶融させ融着させているが、加熱方法としてはこれには限定しない。例えば、プリント配線板7が射出成形用金型1内に形成され保持された状態で射出成形用金型1を加熱して、プリント配線板7全体に熱を加えてもよい。ただしこの場合は配線パターン5以外の部分も溶融温度程度まで加熱されるので、前述の実施例での加熱温度および加熱時間を変更して、この方法に適合した加熱条件を設定する必要がある。

【0026】このほかに、配線パターン5が転写されたプリント配線板7を射出成形用金型1から取り出し配線パターン5に大電流を流してその電気抵抗によりこれを発熱させて、基板6と配線パターン5とが接合している部分を溶融させ融着させる方法や、プリント配線板7に外部の素子や回路部品などをはんだ付けする際に、フローはんだ付けやペーパーリフローはんだ付けなどのための加熱時の熱で配線パターン5および基板6を加熱して、配線パターン5と基板6とを融着させる方法などを用いてもよい。

【0027】また、本発明において用いるべき熱可塑性樹脂には、プリント配線板として適切な電気絶縁性、耐熱性、耐湿性、および成形性の良さ、などを備えたものであることが要求されるが、これに適合するものとしては、前述の実施例で用いたポリフェニレンサルファイド樹脂の他に、例えばポリカーボネート樹脂、ポリスルホン樹脂、ポリエーテルスルホン樹脂、ポリアセタール樹脂、ポリエーテルケトン樹脂、ポリエーテルイミド樹脂、ポリフェニレンオキサイド樹脂などが挙げられる。

【0028】本実施例では、製造するプリント配線板の例として、図1に示すように実際にはプラスチックチップキャリアを選んでいる。これは、プラスチックチップ

キャリアは中央に凹部を有して立体的な形態をしており、本発明の製造方法に係るプリント配線板の趣旨に適合しているためと、チップキャリアはその形態上本発明の実施例の試作品として手頃な寸法と形状であることによる。しかし本発明はこの実施例のような形態のプラスチックチップキャリアのみに限定されず、射出成形によるプリント配線板全般の製造、特に管体などの形状に形成される立体的なプリント配線板の製造に好適な技術である。

【0029】

【発明の効果】以上詳細に説明したように、本発明のプリント配線板の製造方法によれば、射出成形によるプリント配線板の配線パターン形成において、配線パターンのファインパターン化が実現できかつ配線パターンを短時間で形成できるようにし、さらに配線パターンの被着強度を向上させた射出成形によるプリント配線板を提供することができる。

【図面の簡単な説明】

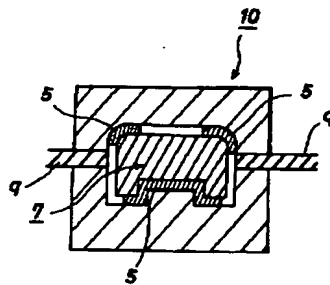
【図1】本発明の製造方法に係る射出成形用金型およびそれにより形成されるプリント配線板を示す側面断面図。

【図2】本発明の製造方法に係る加熱用金型およびそれが圧接されたプリント配線板を示す側面断面図。

【符号の説明】

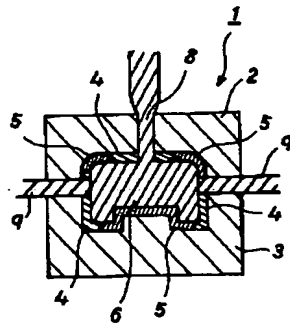
- 1…射出成形用金型
- 2、3…射出成形用金型本体
- 4…電気めっきレジスト
- 5…配線パターン
- 6…基板
- 7…プリント配線板
- 8…注入口
- 9…支持棒
- 10…加熱用金型

【図2】

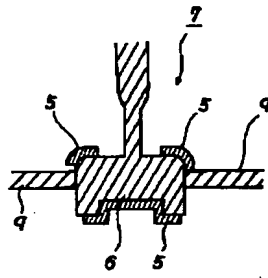


(5)

【図1】



(a)



(b)